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Soft-Side of Logistics

Apr 04



U.S. AIR FORCE

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Purpose



Rapidly delivering war-winning capability

Reexamine the ILS Elements, with particular attention paid to the challenges associated with Software-Intensive Systems.

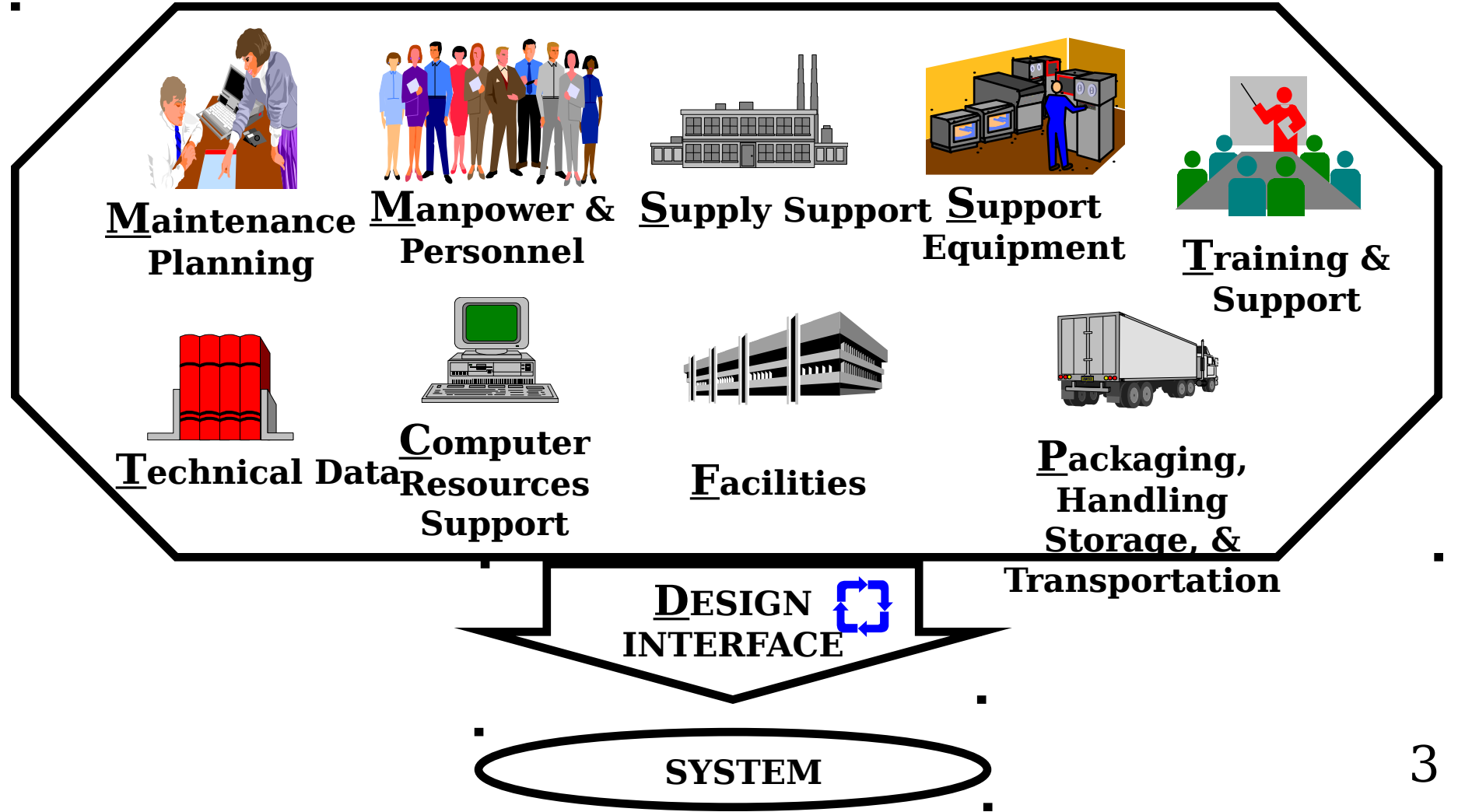




Integrated Logistics Support Elements



Rapidly delivering war-winning capability



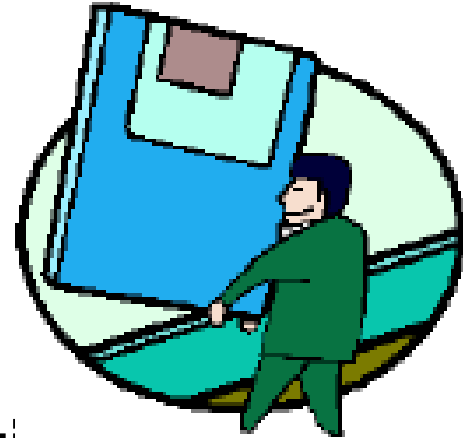


Definitions



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- ***Logistics:*** Getting the right thing;
to the right place;
at the right time;
in the right quantity;
at the right price.
- ***Acquisition Logistics:*** Activities that ensure supportability is considered throughout the acquisition process to minimize support costs; as well as activities that provide the user with resources to sustain the system in the field.



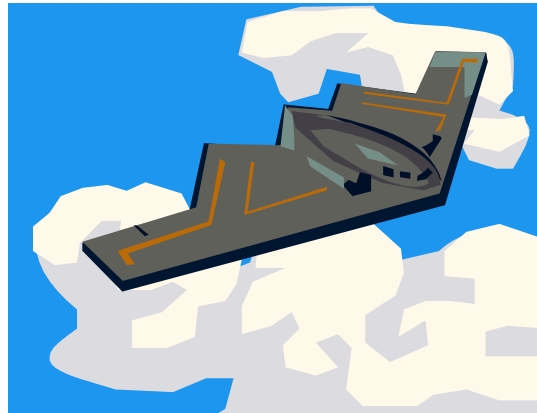
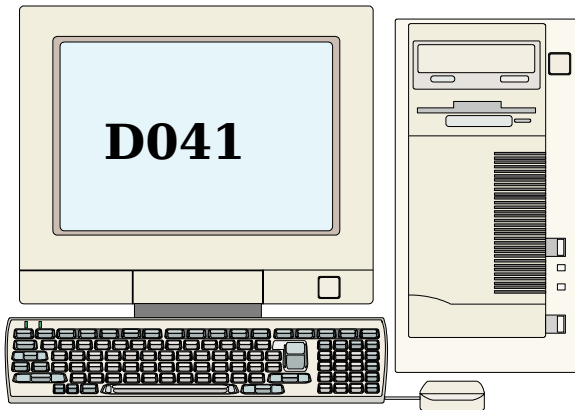


Definitions



Rapidly delivering war-winning capability

- ***“Soft-side of Logistics”***: Logistics planning and processes required to support the life cycle sustainment of software and software intensive systems





Software Supportability

What's Involved?

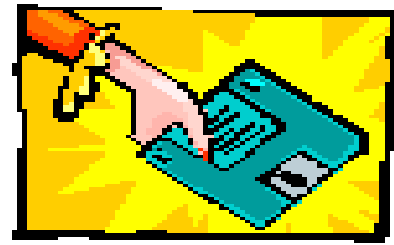


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Development Environment



Sustainment Environment



Avionics Software



Simulator Software



Ground Support Equipment



Diagnostic/Operating Systems Software





Hardware / Software

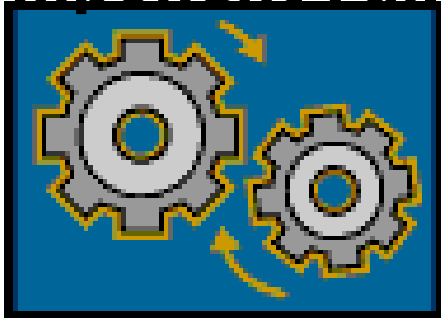


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• Significant Differences in Supportability Requirements!

Hardware

- Tangible, Materiel Intensive
- Deteriorates Over Time
- Requires Preventative Maintenance
- Problem Caused by Component Failure



Software

- Intangible, Labor Intensive
- Adapts Over Time
- No Physical Preventative Maintenance Needed
- Problem Caused by Embedded Error



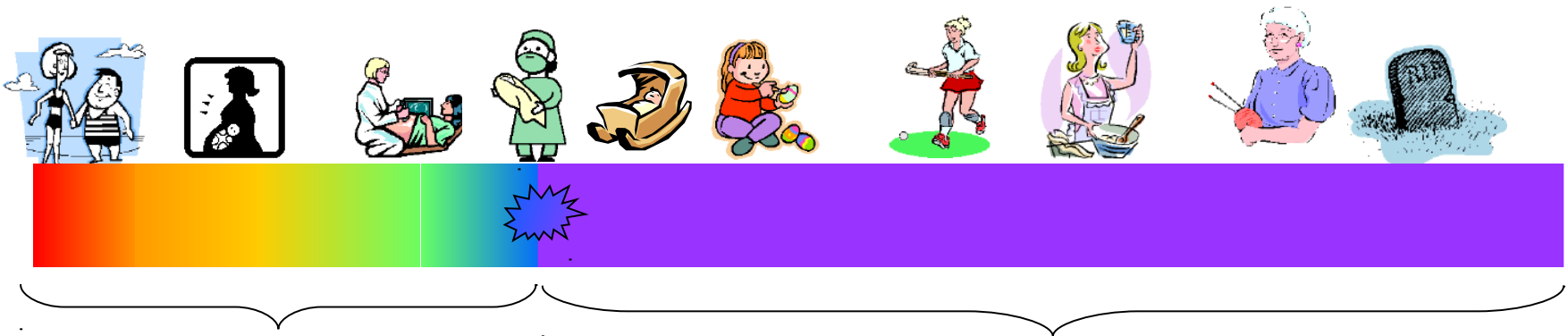


Software Lifecycle



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Typical Software Lifecycle Cost/Effort Distribution



Development: 25-33% **Support or Maintenance: 66-75%**

- Requirements Definition
- Architectural Design
- Detailed Design
- Code / Implementation
- Testing
- Adaptive Changes
- Corrective Changes
- Software Enhancements



Software Supportability Guidance



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Interim Defense Acquisition Guidebook

- Para 2.8, Supportability
- Para 6.4, Command Control,
Communications,

Computers &
Intelligence Support (C4ISP)

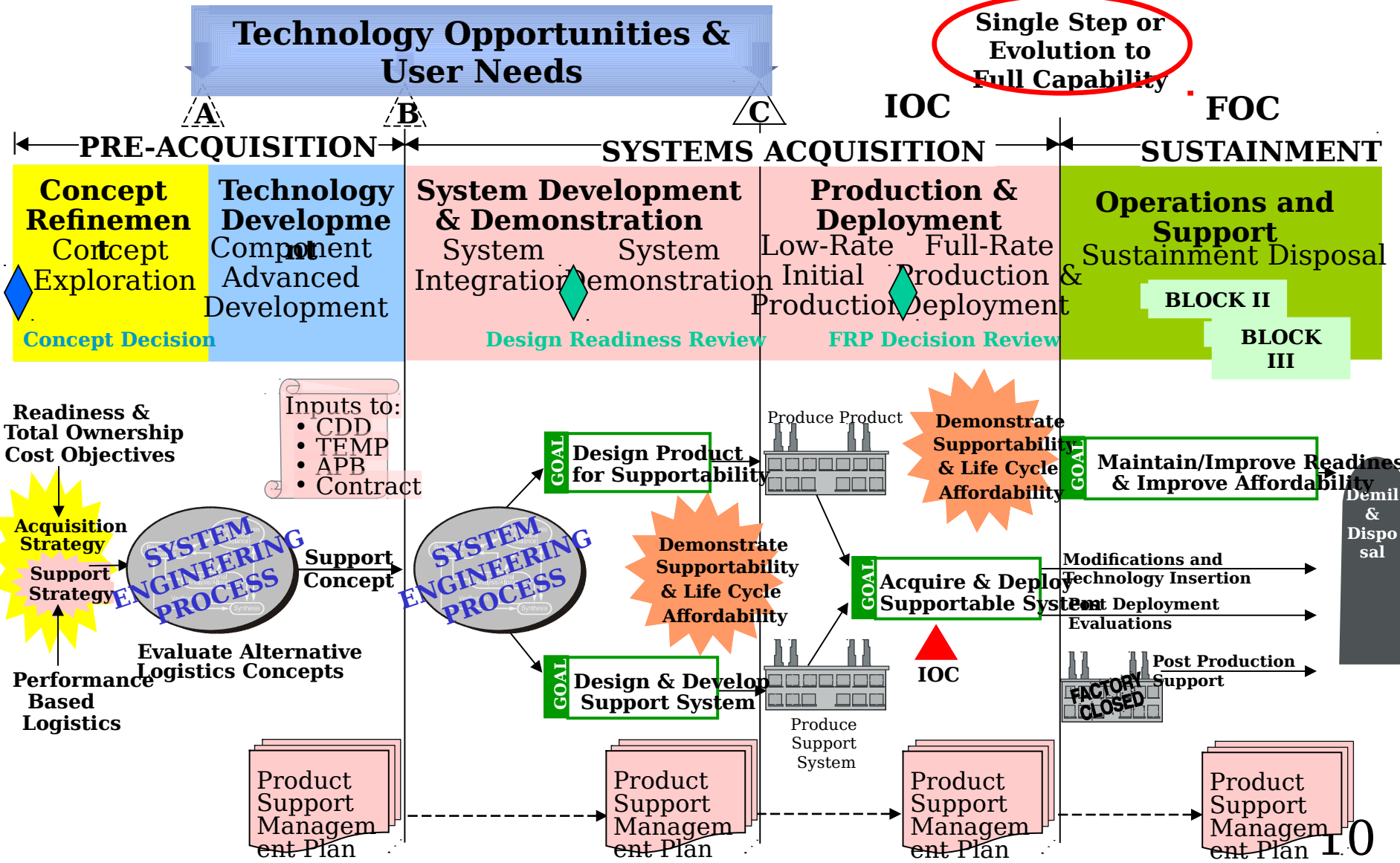
**AFI 63-107, Integrated Product
Support Planning &
Assessment**



Logistics Management Process



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Integrated Logistics Support Elements



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Maintenance Planning

Maintenance Planning:

Software: - Should begin early in the acquisition process. Establishes software support concepts and requirements for the lifecycle of the system. Should address who will maintain the software, what facilities, personnel skill-sets, support equipment, support software, test resources, training facilities,... will be required to support

Should be documented in a Software Supportability Plan. Program Management Office oversees establishment of lifecycle development and support of the software system and support infrastructure.



Software Maintenance



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- **Approx. 80% of maintenance effort is expended to support changing user requirements and environments (*adaptive & perfective* software changes)**
- **20% maintenance effort expended to correct software problems (*corrective* changes)**

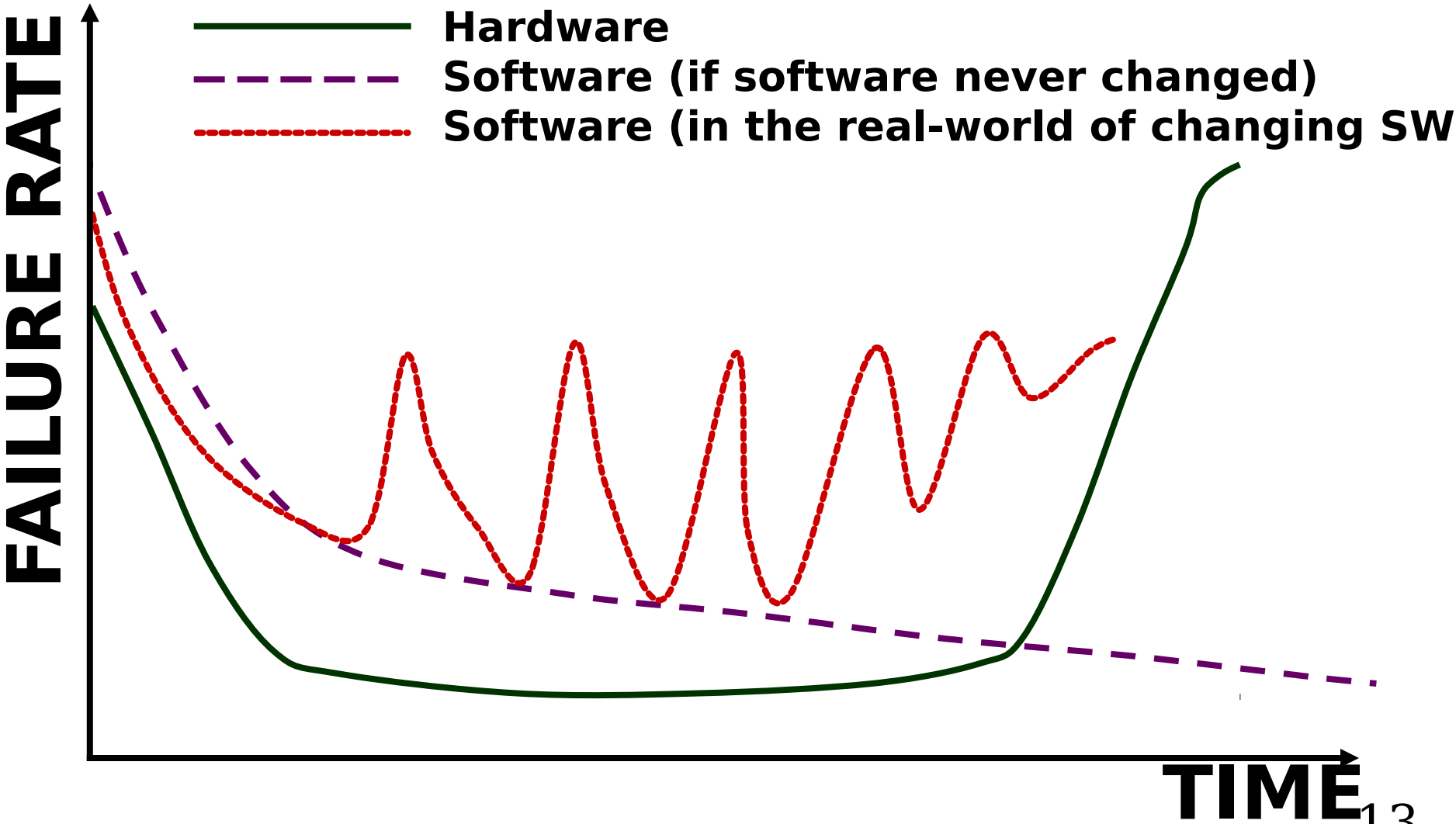




Failure Rate Trends



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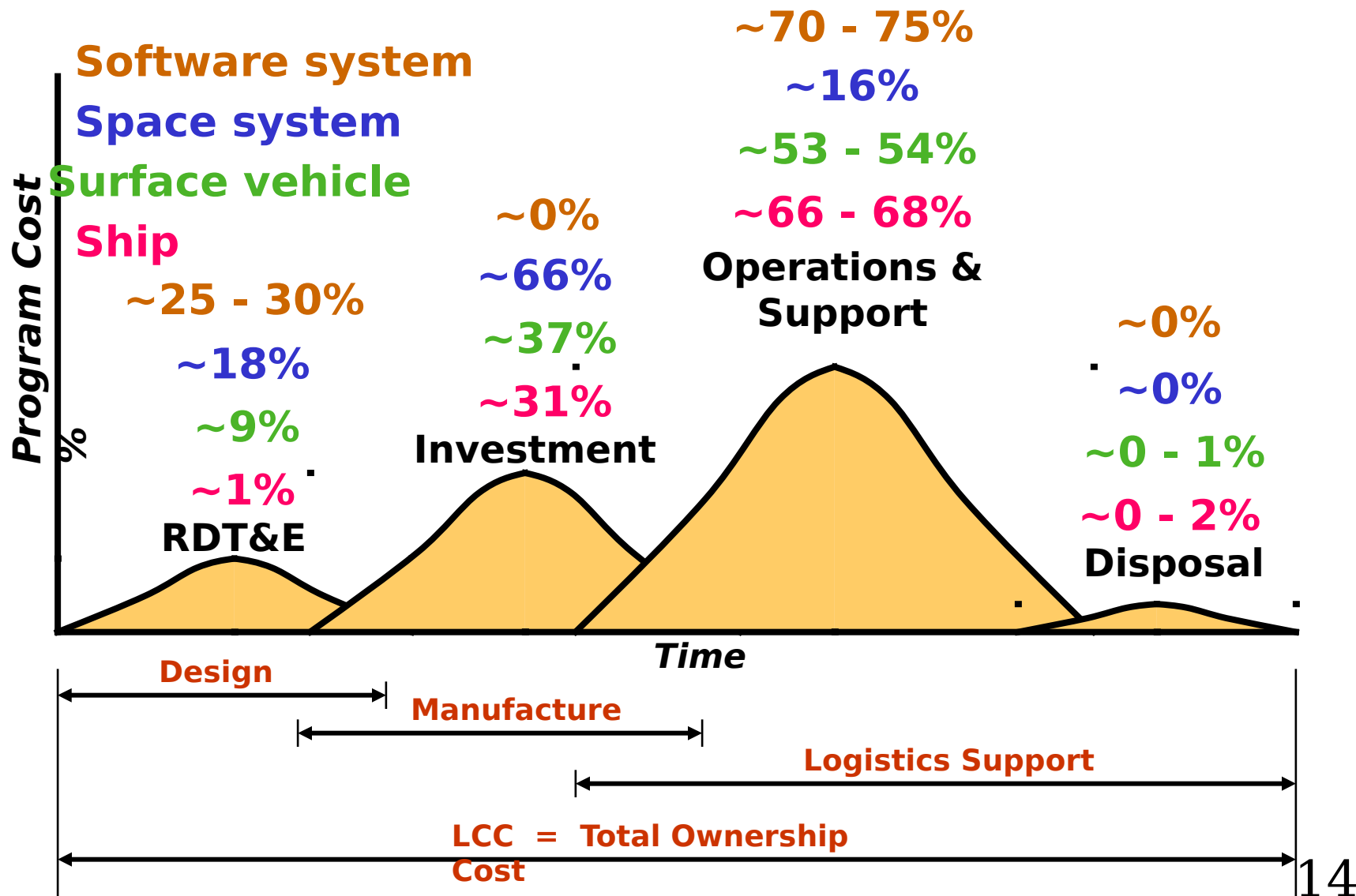




Cost During Program Life



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Integrated Logistics Support Elements



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**Maintenance
Planning**



**Manpower &
Personnel**

Manpower & Personnel:

Software: Labor hours and skill levels required to develop, operate, maintain, and support systems over its lifetime. Involves choosing “In-House”, “Developer”, or “Outside Maintenance” activity to perform maintenance. Includes Systems Engineers to develop, day-day users, on-site IT personnel to install upgrades/reboot system, and programmers to modify system functional/operational performance as a result of a PR/SCR. Early identification is essential.



Manpower & Personnel



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- **Who Should Perform Software Maintenance?**
 - **Developer?**
 - **Outside Maintenance Activity?**

Developer



*Outside
Activity*

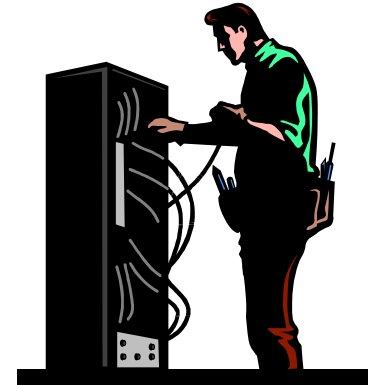
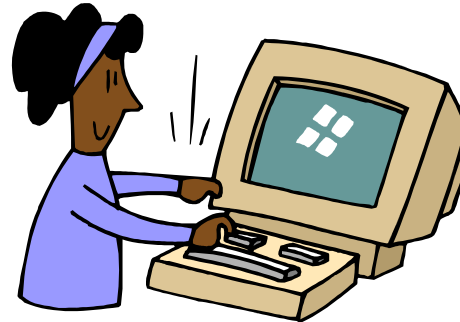


Manpower & Personnel



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- How Many People Do We Need?
- What Skill Levels Are Required?
- Government or Contractor Resources?





Maintenance Performer Advantages



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Developer Pros:

- Better Knowledge of System
- Less Reliance on Documentation
- Better Communications Developer & Maintainer
- Continue working with known/proven organization

Developer Cons:

- Poorer Quality - Documentation
- Possible Loss of Development Staff / Poor Morale
- Too Much Time Spent Perfecting System Design

Separate Maintainer Pros:

- Fresh Look at System Design
- Better Documentation?
- Identify Strong/Weak Points of System
- Leaves Maintenance with Maintainers

Separate Maintainer Cons:

- Slower Transition
- Learning Curve for New Staff (Slow Transition)
- User Support May Suffer - Credibility



Integrated Logistics Support Elements



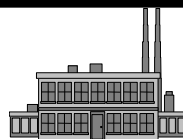
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Maintenance Planning



Manpower & Personnel



Supply Support

Supply Support:

Software: In the Software world there are no spare/replacement parts to acquire, catalog, receive, store, transfer, and dispose. Supply Support for software consists of ensuring management actions, procedures, and resources are in-place to support customer requirements to fix software deficiencies (Software Deficiency Reports) or expand software system capabilities (Software Change Reports). Also to ensure changes are tracked/documented in a Configuration Control



Supply Support



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- Setup **Process** to Handle Customer Requests:
 - Software Deficiency Reports (SDR's)
 - Software Change Requests (SCR's)
 - Configuration Management
 - Configuration Boards and Control





Supply Support

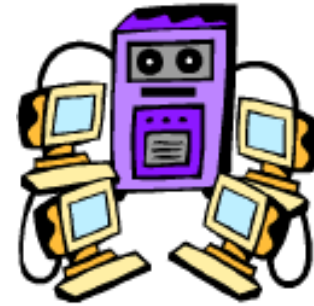


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Helpdesk



Computer Resources



Buildings



Programmers





Integrated Logistics Support Elements



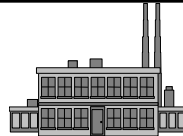
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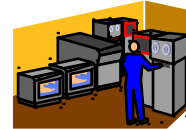
**Maintenance
Planning**



**Manpower &
Personnel**



Supply Support



**Support
Equipment**

Support Equipment:

Software: All equipment required to support the creation, testing, operation and maintenance of a system. Support equipment includes: On-line maintenance and diagnostic programs, built-in test software, Test Program Sets, and support Software (operating systems, database management systems, configuration management, etc.).

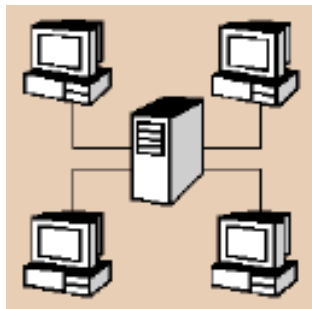


Support Equipment



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Network

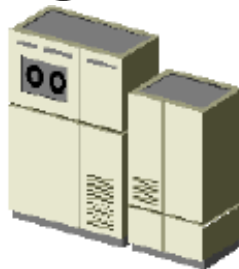


all in a
warfighting
environment

Development Environment



Test/Pre-Production Test/Development Environment Software





Integrated Logistics Support Elements



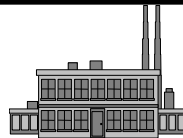
Rapidly delivering war-winning capability



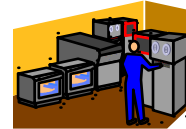
**Maintenance
Planning**



**Manpower &
Personnel**



Supply Support



**Support
Equipment**



**Training
&
Support**

Training & Support:

Software: Training and Training Support consists of the processes, procedures, training software (such as CBT and WBT) used to train civilian and military personnel to operate and support a software intensive system. Training support can also include management processes and procedures in-place to support training software problems or needed modifications.



Training & Support



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- **Who Should be Trained?**

- Functional Users
- System Maintainers
 - **True, like HW, but much different skill set**
- System Administrators



- **How Should Training be Given**

- Classroom Lecture
- Computer Based Training (CBT)
- System Tutorials





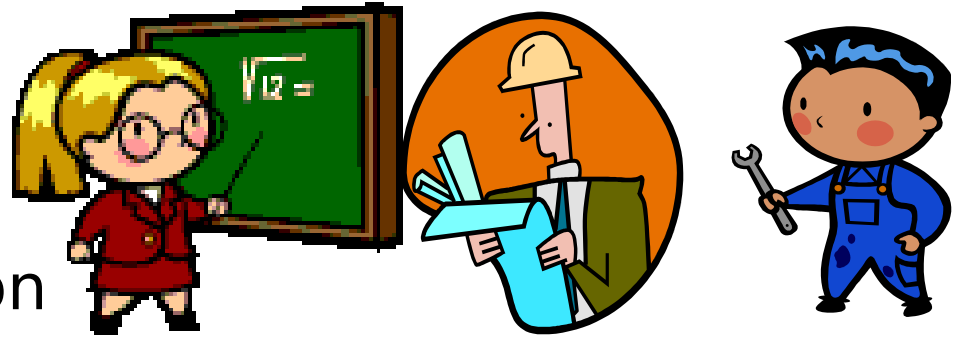
Training & Support



Rapidly delivering war-winning capability

- **Who will Develop/Conduct Training?
For How Long?**

- Developer
- Maintainer
- In-House Organization
- Third-Party Contractor



➤ Updated training for major releases!

- **Don't Forget about Resources Needed
Training!**

- PC's
- Servers
- Software Engineers





Integrated Logistics Support Elements



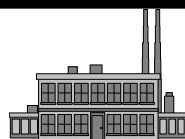
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Maintenance
Planning



Manpower &
Personnel



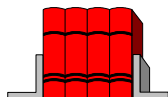
Supply Support



Support
Equipment



Training
&
Support



Technical Data

Technical Data:

Software: Technical Data consists of recorded information regardless of form or character consisting of manuals, system/system-related, and program documentation. (e.g. Operations/Training/Programming Manuals, Source Code, Testing Code, Software Specification and Design Documents, etc.)



Technical Documentation



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- **Create/Update Life Cycle Documentation**
 - **J-STD-016**
 - **Identifies Life Cycle Documentation/Processes For Software Development**
 - **Replaces Mil-STD-498 Documentation/Process Requirements**
 - **IEEE/EIA 12207* or ISO/IEC 12207**
 - **Equivalent Comprehensive Process Description**

*adopted by DoD; 3 vols.





Technical Documentation



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- **Configuration Management - Tracking**
 - **Software Change Requests (SCR)s**
 - **Software Deficiency Reports (SDR)s**
 - **Software Releases (Versions/Patches)**
 - **How Many Configurations are being Managed??**
 - **Both Planned and Previous...**



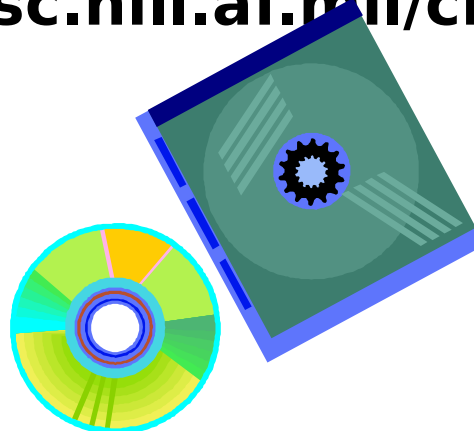


CPINs



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- **Computer Program Identification Number**
 - The software equivalent of a NSN
 - Managed by OC-ALC/TILUC, Tinker AFB, OK
- **Automated Computer Program Identification Number System (ACPINS)**
 - See CROSSTALK The Journal of Defense Software Engineering March 2000, pgs 16-17
 - <http://www.stsc.hill.af.mil/crosstalk/2000/03/index.html>

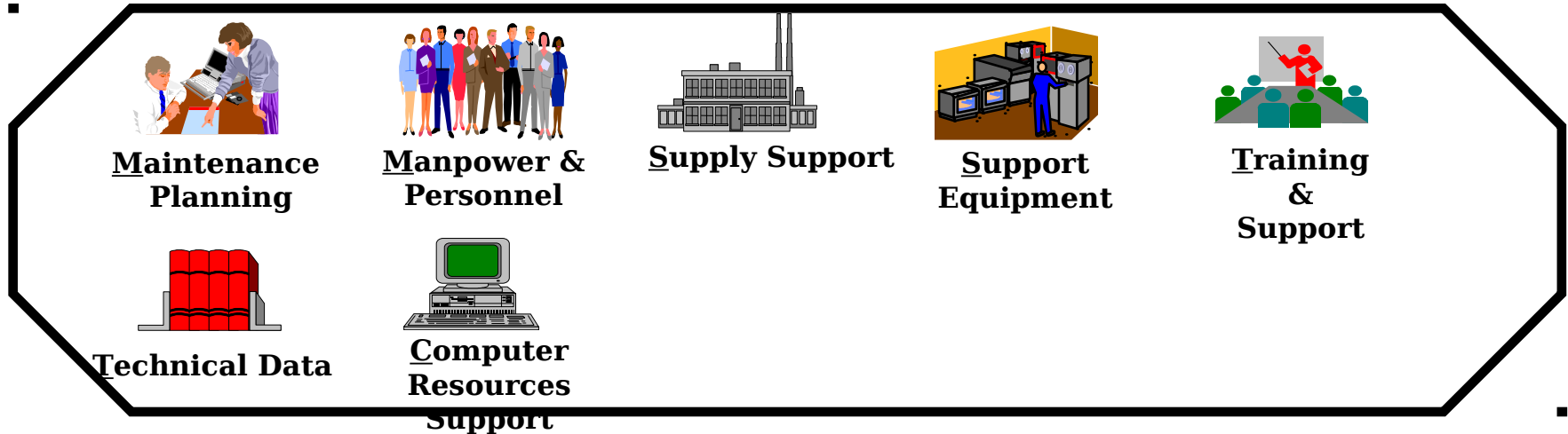




Integrated Logistics Support Elements



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Computer Resources Support:

Software: Computer Resources Support encompasses the facilities, hardware, software, documentation, manpower, and personnel needed to operate and support software intensive systems.



Computer Resources Support



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- CRS
 - Begin Early in the Life Cycle
 - Ensures Supportability Considered Throughout Life Cycle
 - Generational Change 18-24 Months
 - Develops Support Plans – **Functional IPT**
 - Required to ensure System Availability/Sustainability

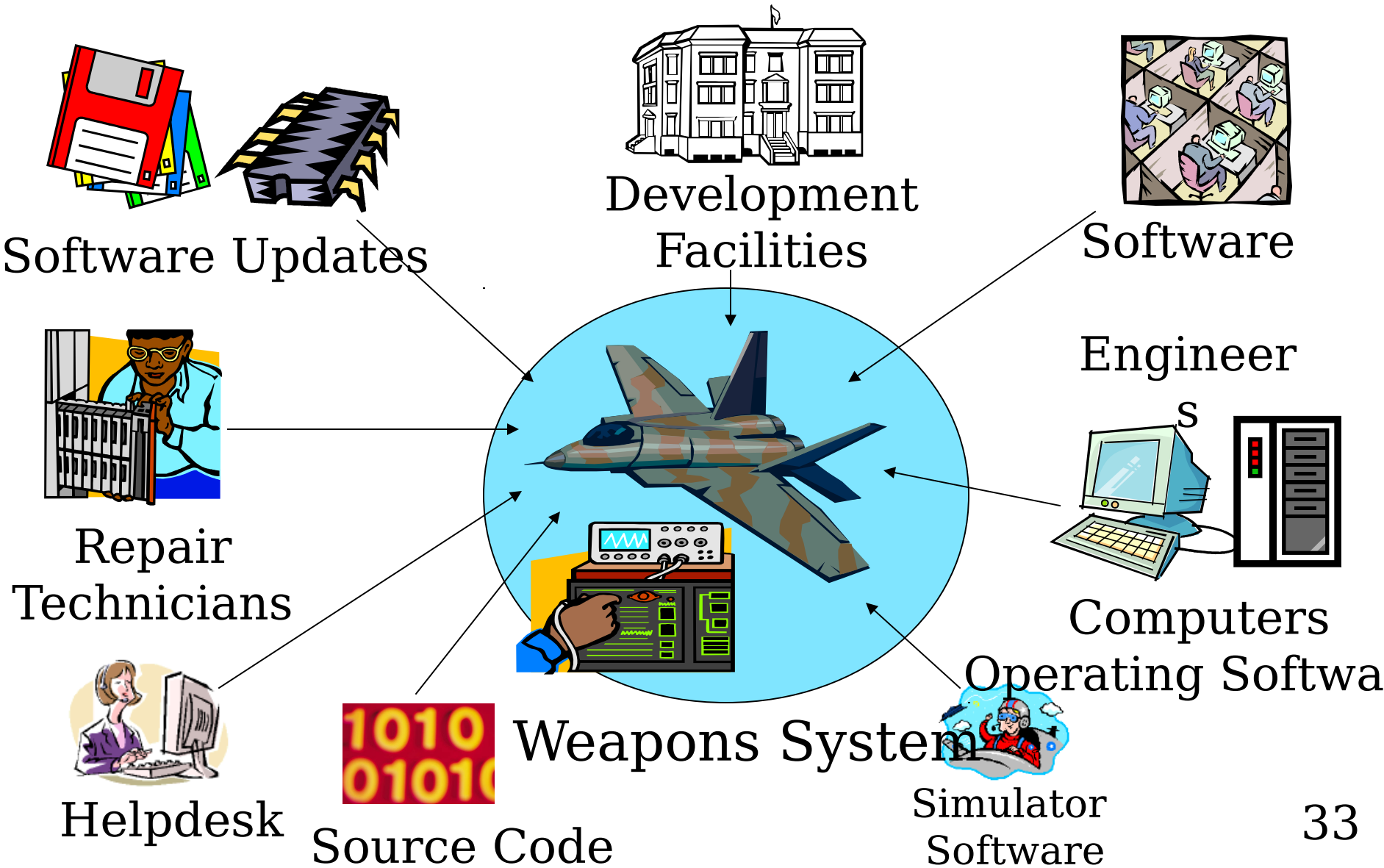




Computer Resources Support Umbrella



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Computer Resources Support



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- Computer Resources Support Team
 - Team of **Functional** Experts - Develops and Refines Computer Resources Support (CRS) Strategy
 - Begin Early in the Acquisition Process





Computer Resources Support



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- **Supporting Documents**

- **C4ISP - Command Control Communications, Computers, and Intelligence Support Plan (Interim Guidebook, formerly DOD 5000.2-R)**
- **CRLCMP - Computer Resources Life Cycle Management Plan (Computers) (AFR800-14 and DODI5000-2AFSUP1)**
- **CRISD - Computer Resources Integrated Support Document (Software) (MIL-STD-2167A and DI-MCCR-80024A)**

**Older
Docs**





DII/COE IMPACTS



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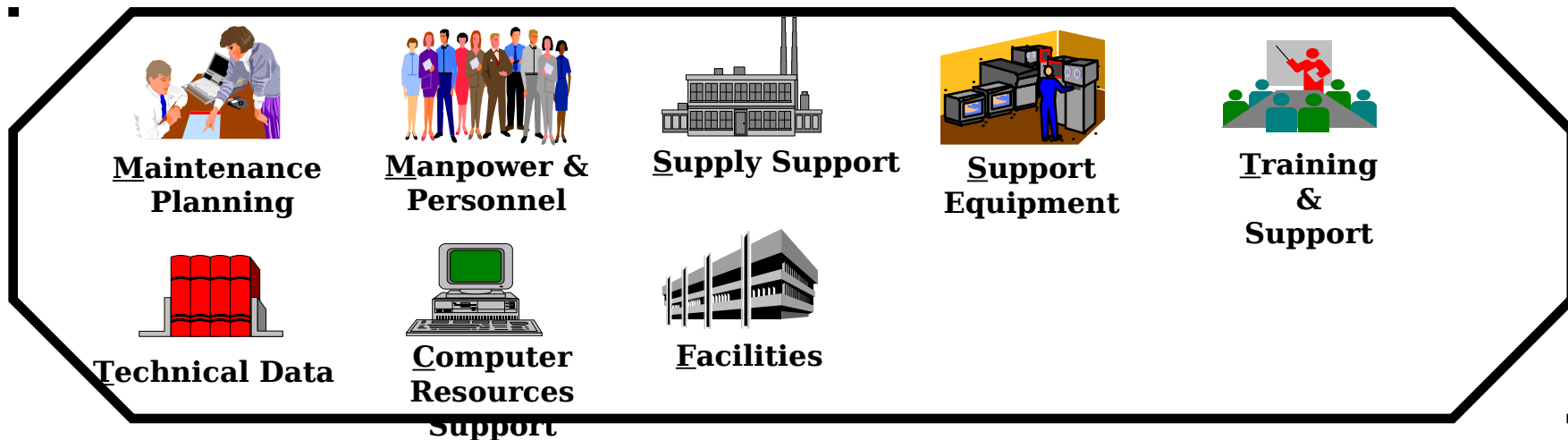
- **DII/COE for Affected Systems:**
 - **Ensure Operating System and Windowing are Compliant with Latest Version of Kernal**
 - E.G. Unix `_._`, Windows XP, Kernal 4.1
 - **Ensure Mission Application Meets Min. Level 5 Compliance with goal of Achieving Level 8**
 - **Ensure Mission Applications are Installed Using the COE Tools**



Integrated Logistics Support Elements



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Facilities:

Software: Facilities consist of the permanent and semi-permanent real property assets required to support a system (Primary/COOP), including studies to define types of facilities or facility improvements, location, space needs, environmental requirements, connectivity to LAN/WAN, access to primary/backup power supply, security, and equipment. Includes computer terminals, servers (Development/Test/ Production), Fire-Walls/Intrusion detection services



Facilities



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- **Facility Requirements**
 - **Identifies the Resources Needed to Create/Support a Sustainment Environment**
 - **Offices**
 - **Cubicles**
 - **PCs**
 - **LAN/WAN Connectivity**
 - **Computer Room**



Facilities



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- **Organizational Maintenance Facilities:**

- Repair Shop
- Work Benches
- Computers/Servers
- Special Diagnostic Equipment



- **Depot Maintenance Facilities:**

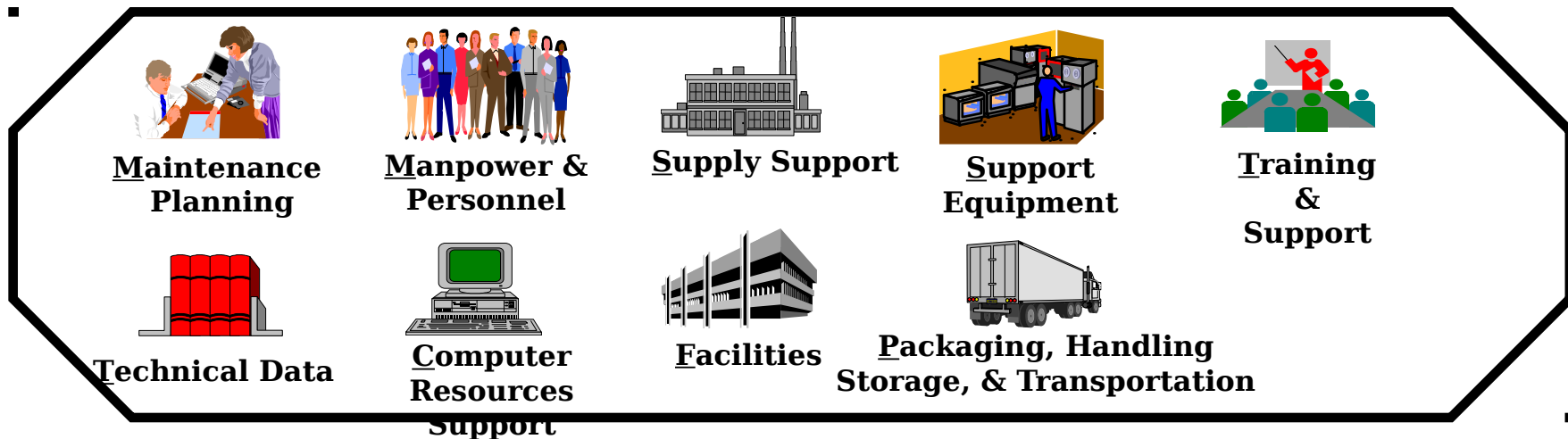
- Computers/Servers
- Offices/Conference Rooms
- Cubicles for Developers



Integrated Logistics Support Elements



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Packaging, Handling, Storage & Transportation:

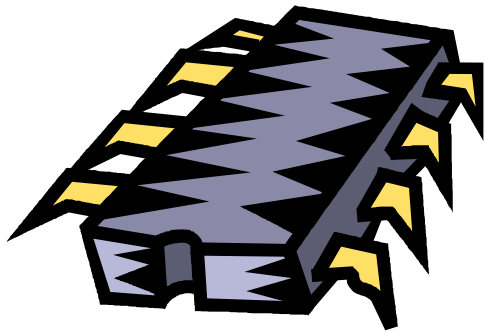
Software: This element ensures processes are in place to distribute software and documentation updates to the system operators and maintainers. Software updates may be made available via web downloads, or mailed CD/disk.

Packaging Handling, Storage, Transportation

Rapidly delivering war-winning capability



- **Getting Software/Updates to the Field:**
 - **CD**
 - **Web-Download (not a HW option!)**
 - **Electronic Transfer (FTP/MQ Series)**
 - **IC-Chip Replacement**

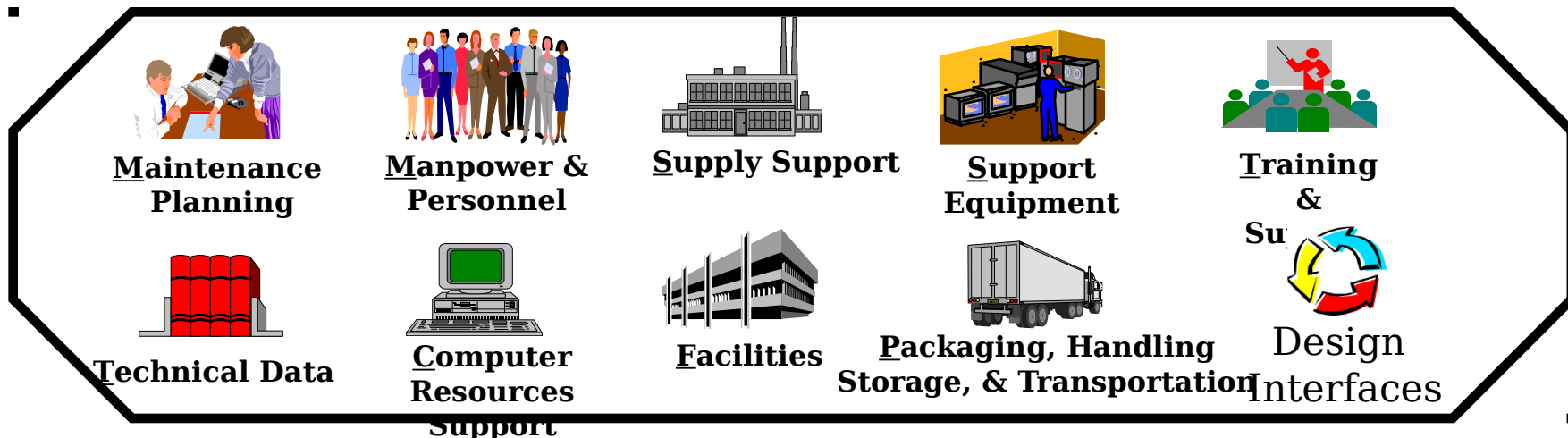




Integrated Logistics Support Elements



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Design Interfaces:

Software: This element ensures processes and resources are in-place to establish and update interfaces between the software system and external systems such as GCCS. Configuration Management and documentation of Interface Requirements Specifications (IRS) are key elements required to document and track the establishment and update of interfaces.

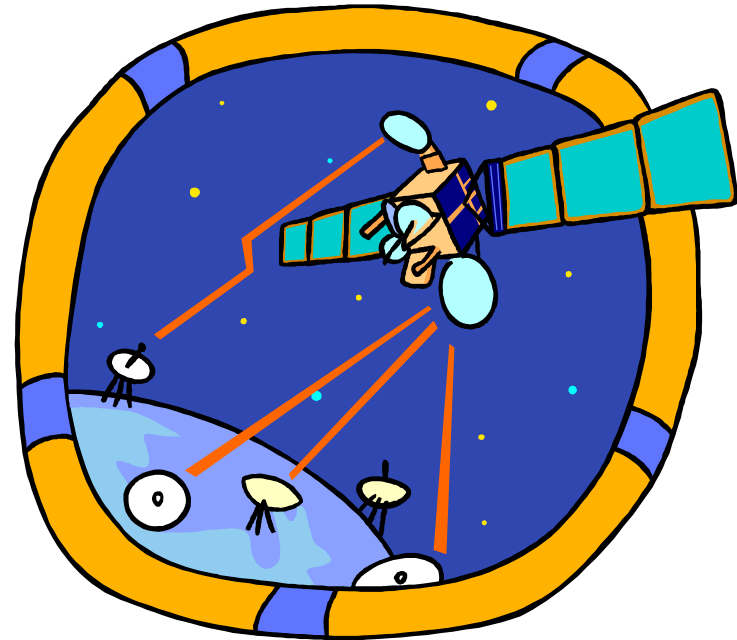


Design Interfaces



Rapidly delivering war-winning capability

- **Most likely thing to eat your lunch!**
 - Who is in charge of the “seams” between systems?
- **C4ISP, Interface Control Documents (ICDs)**

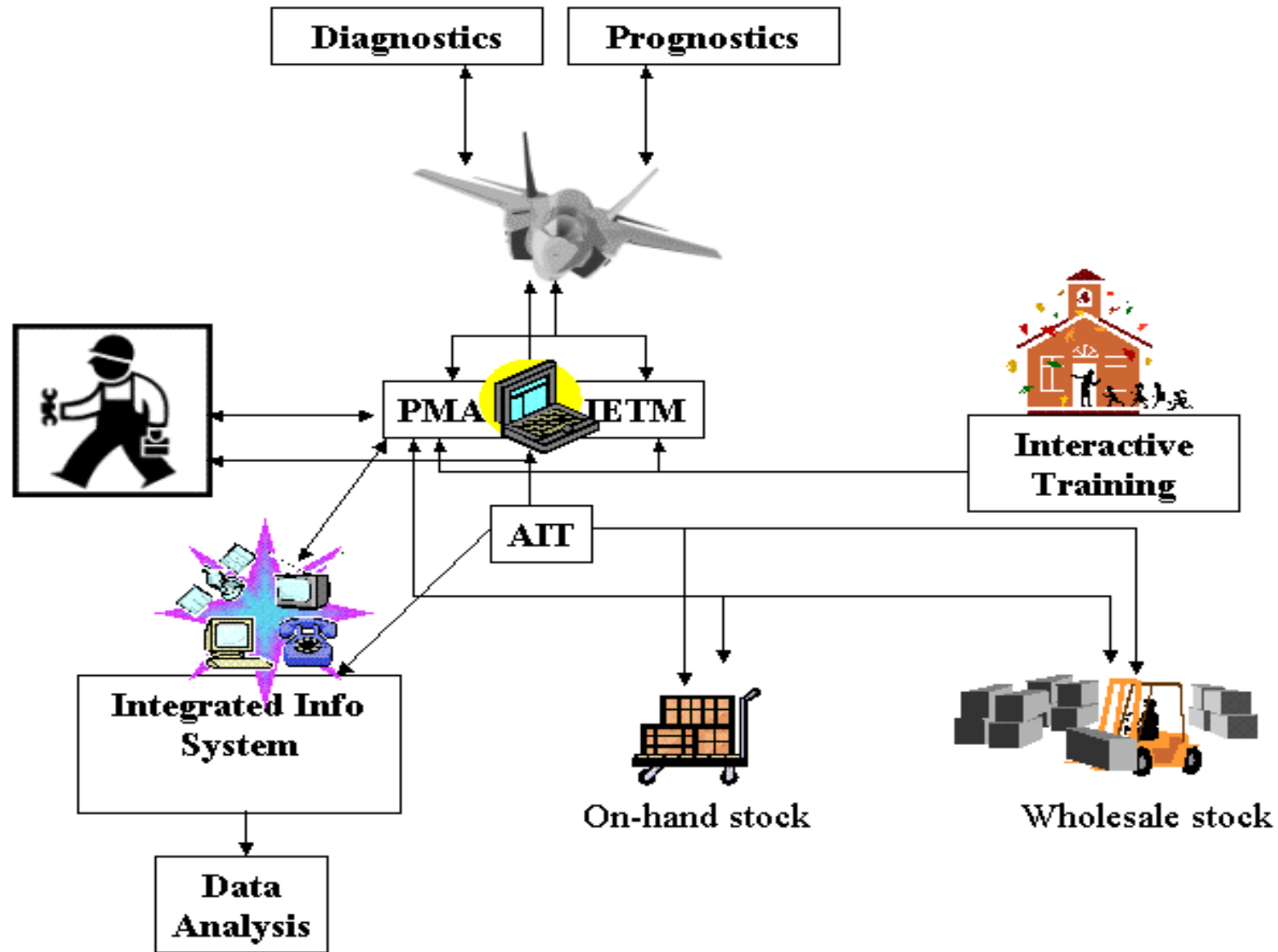




Condition-Based Maintenance Plus (CBM+)



Rapidly delivering war-winning capability





Condition-Based Maintenance Plus (CBM+)



Rapidly delivering war-winning capability

- **CBM**
 - Goal: To Perform Maintenance Only When Needed
 - **Embedded Sensors or External Tests Evaluate the Health of a Weapons System**
 - **Utilizes Automatic Identification Technology (BIT-Test, Prognostic Health)**
- **CBM+**
 - **Expands upon CBM to include Integration of Logistics Information Systems Technologies and Enhanced Business Processes**
 - **Encompasses Other Technologies, Processes, and Procedures that enabled Improved Maintenance and Logistics Practices**



Condition-Based Maintenance Plus (CBM+)



Rapidly delivering war-winning capability

- **Characteristics:**

- Hardware - embedded sensors; integrated data bus
- Software - decision support and analysis capabilities, on/off equipment
- Design - open system architecture; integration of maintenance and logistics information systems; interface with operational systems. Joint Total Asset Visibility (JTAV)
- Processes - Reliability Centered Maintenance (RCM) program development; a balance of reactive, preventive, and predictive maintenance processes
- Tools - Interactive Electronic Technical Manuals (IETMs) (digitized data); automatic identification technology (AIT); portable maintenance aids (PMA); embedded, data based, interactive training
- Functionality - fault: detection, isolation, and prediction

C-17 Maintenance Tools

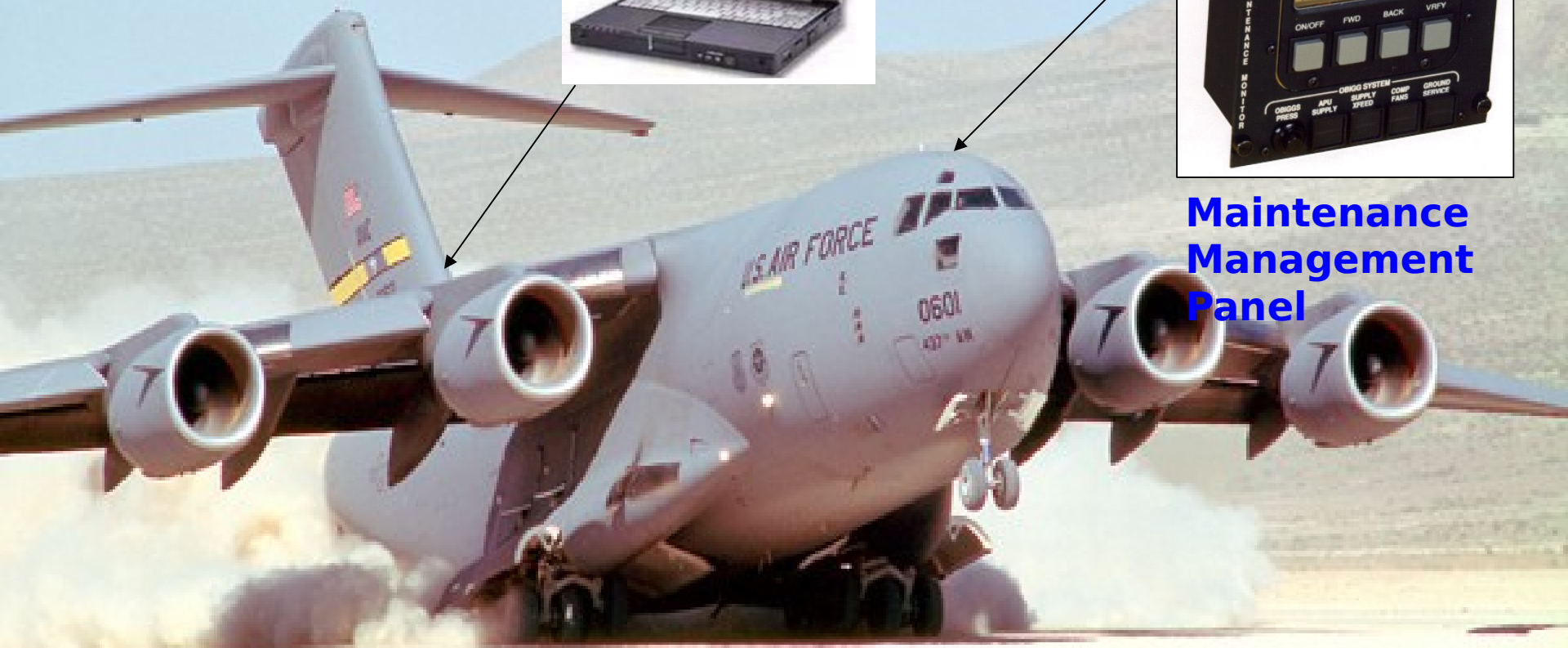
**Support Equipment
Computer (SEC)**



**Fault-Function
Indicator Panel**



**Maintenance
Management
Panel**



Condition-Based Maintenance

F-16 Maintenance Tools

F-16 Enhanced Diagnostic Aid (EDNA)





F-22, Portable Maintenance Aid



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F 22 DataTrak 11 lb



- Verifies System Failures
- Electronic Tech Manuals
- Order Parts from Flight
- Records Maintenance A



F-35 LM-STAR



Rapidly delivering war-winning capability



Prognostic Health Management

- Diagnose Health
- **Predict Failures**
- Linked to Ground



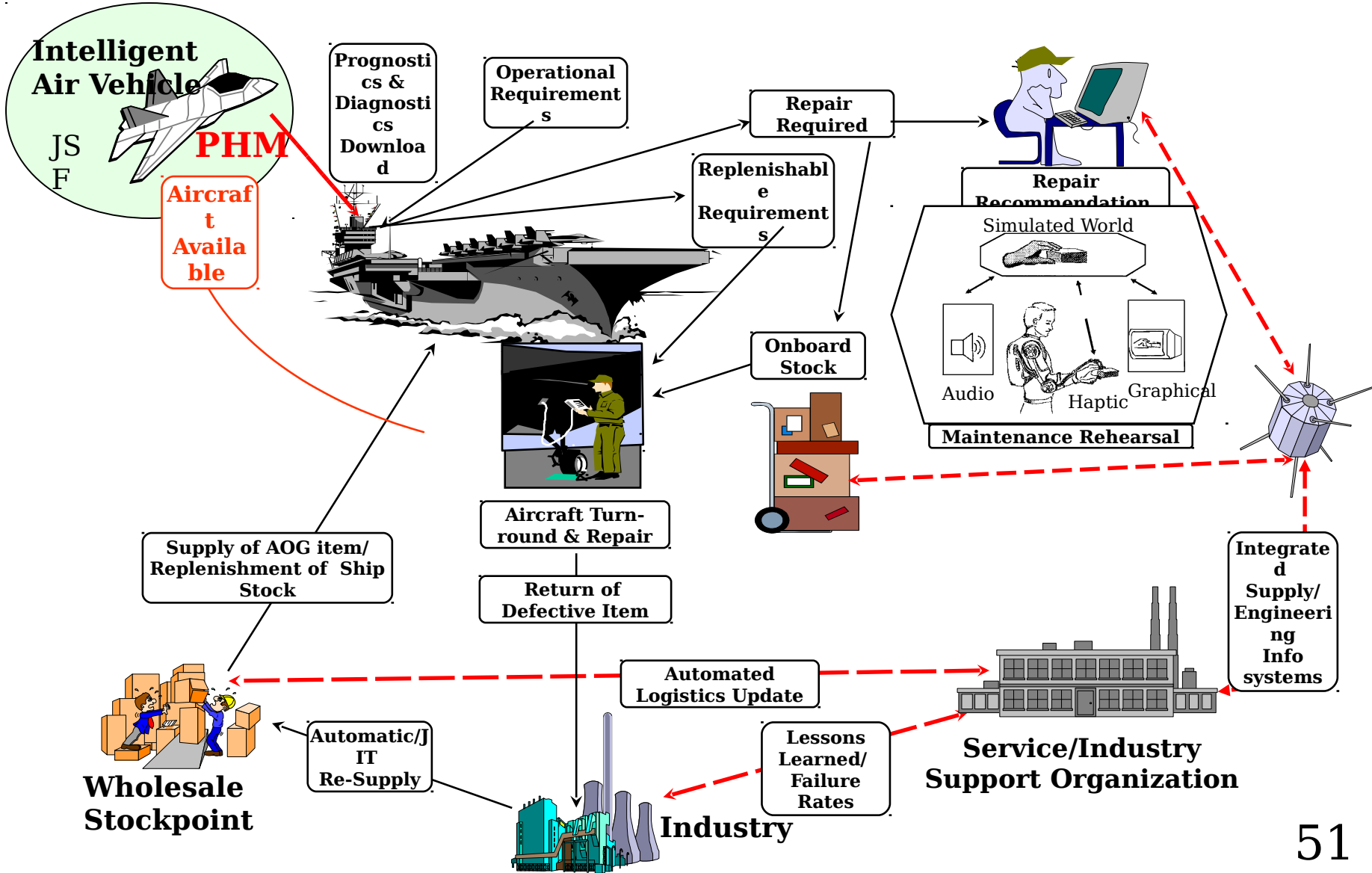


PADHM Generic Approach

Aviation
Logistics
Board



Rapidly delivering war-winning capability



Provide the right
information at the right
time, in the right way, so
commanders can do the
right things at the right
time in the right way

Future combat operations



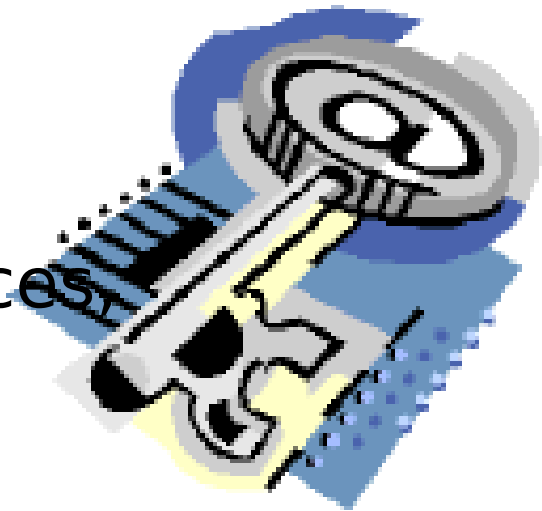


Key Points



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- Address software supportability issues early. Nearly 70 percent of a software system's lifecycle cost is allocated to software support.
- Initiate support planning early to ensure that the capability to support the software exists before it is needed.
- Ensure the software developed is supportable:
 - Facilities, Tools, Documentation
 - Data Rights
- Many similarities between hardware, software support, but many significant differences, too.





Tips to live in the real world



Rapidly delivering war-winning capability

- **Enforce contract deliverables**
 - Especially if the maintenance organization is the same as the development organization
 - Assure the maintainers get to review data
 - Don't delay down-streaming equipment, tools, etc.
- **Make use of “fall out money” to buy:**
 - Data, tools & equipment, target systems, etc.
- **Champion formal planning documents**
 - Most notably, the CRLCMP, if there is one
- **Take a maintainer to a meeting**
- **Have version 1.1 built jointly with the maintainers**